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ON-GOING STUDIES OF FUEL CLOUD FORMATION IN FUEL TANK ULLAGE

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ABSTRACT

A cloud of suspended fuel droplets may be formed when fuel residue in an essentially empty aircraft fuel tank is heated before take-off and then cooled while climbing after take-off. The ongoing study consists of an experimental investigation of the formation of suspended fuel droplets in a large temperature-, pressure- regulated fuel tank segment which is designed to simulate realistic fuel tank vapor dynamics leading to the formation of an explosive fuel vapor droplet/air mixture. The tank vapor/droplet dynamics are being studied using Phase-Doppler Particle Analyzer (PDPA) equipment that was recently installed in the facility. Results include: assessment of conditions that promote or inhibit droplet formation by homogeneous condensation, discussion of the importance of the competition between gas-phase and surface condensation, and discussion of the impact of the findings on the risk of fire and explosion in aircraft fuel systems.

CWT THERMAL MODELING FOR STUDIES OF FUEL CLOUD FORMATION IN FUEL TANK ULLAGE

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The previous paper highlighted the importance of matching the conditions in the WSU fuel tank test cell to those of center wing fuel tanks. As a result, work is being done to provide additional details on tank conditions in support of this research program. This work provides center wing fuel tank thermal modeling results for ranges of ambient/fuel temperatures, mass loading, and ground/flight profiles. These results will be used to provide operating conditions such as wall surface temperatures for experimental studies.